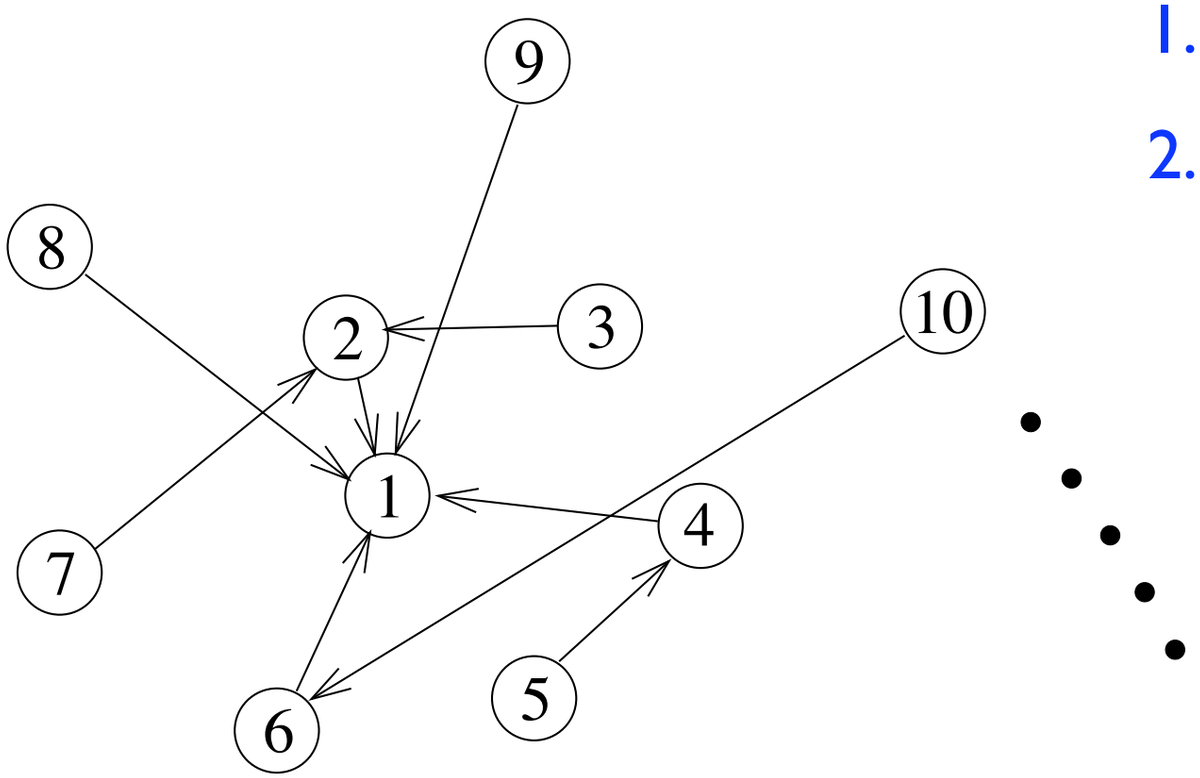
Dynamics of Growing Networks & Evolving Media

DMR-0227670, S. Redner, collaborator P. L. Krapivsky

Question: What is the structure of growing heterogeneous networks?

(motivated by citations, world-wide web, etc.)

e.g., Barabari-Albert model



1. Introduce nodes one at a time
2. Attach to earlier node with k links at rate A_k

Complete solution by rate equation

Basic observable: N_k, the number of nodes with k links

Rate Equation:
$$\frac{dN_k}{dt} = \frac{A_{k-1}N_{k-1} - A_k N_k}{A} + \delta_{k,1}$$

attachment rate: $A_k \sim k^\gamma$ total rate: $A(t) = \sum_{j=1}^{\infty} A_j n_j$

Solution:
$$n_k = \frac{\mu}{A_k} \prod_{j=1}^{k} \left(1 + \frac{\mu}{A_j}\right)^{-1} \qquad (n_k = N_k/t)$$

Asymptotics:
$$n_k \sim \begin{cases} k^{-\gamma} \exp\left[-\mu\left(\frac{k^{1-\gamma}-2^{1-\gamma}}{1-\gamma}\right)\right] & 0 \le k < 1 \\ k^{-\nu}, \quad \nu > 2 & \gamma = 1 \\ \text{condensation} & \gamma > 1 \end{cases}$$

power law only for linear preferential attachment!